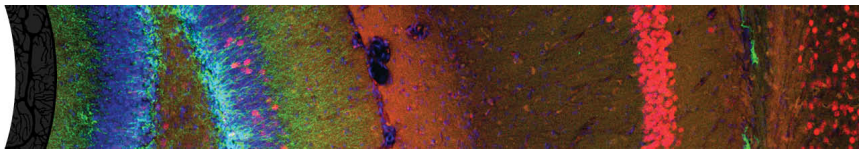
NEUROSCIENCE 2021
50TH ANNUAL MEETING



(https://www.abstractsonline.com/pp8/#!/10485)

Session P136 - Oscillations and Synchrony: LFP Studies I

Add to Itinerary

P136.05 - Co-occurrence of hippocampal theta- and ripple-frequency rhythms in foraging rats

November 11, 2021, 8:30 AM - 9:30 AM | Virtual Only

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Abstract
Brain rhythms have been postulated to play central roles in animal cognition. The occurrence of theta- and ripple-frequency hippocampal rhythms is known to be significantly dissociated with respect to both physiology and behavior. While θ-frequency (4-12 Hz) oscillations are assigned to encoding processes during exploratory behavior and rapid eye movement (REM) sleep, ripple-frequency (120-250 Hz) oscillations are linked to consolidation phenomena during non-REM sleep and wakeful rest. However, as the two oscillations are differentially expressed across hippocampal ***strata***, reports of exclusivity need validation through simultaneous recordings across ***strata***. Additionally, intracellular counterparts of sharp waves (dendritic plateau potentials), that occur in close association with ripples, have been observed simultaneously during θ oscillations. Motivated by these observations, we assessed their potential co-occurrence by recording hippocampal extracellular potentials from rats (***n***=3) that foraged in an open arena using 32-channel silicon polytrodes spanning different ***strata***. We identified individual ***strata*** based on histology, laminar profiles of extracellular signals during sharp wave ripples (SPW-Rs), and characteristic cross-***strata*** θ-phase reversal. Theta epochs and ripple events were exclusively identified from the distal ***stratum radiatum/stratum lacunosum moleculare*** and ***stratum pyramidale*** respectively, to account for their differential expression profiles. A simultaneous detection of the two rhythms from their respective ***strata*** was defined as a co-occurrence, termed as ***θ ripple*** events. Across rats, we found 10-20% of total ripples to be ***θ ripples***, with the frequency of occurrence of ripples within θ epochs (median across sessions: 0.2-0.4 Hz) higher than their occurrence outside (0.1-0.2 Hz). Further, we found the magnitude of θ power during and in the vicinity of ***θ ripples*** to match that within identified θ epochs. We also assessed the behavioral state of the rat during ripple events, and found a distribution of ripple kinds - e-θ, i-θ, e-nonθ, and i-nonθ, with distinctions based on physiology (θ ***vs.*** non-θ epochs) and behavior (exploratory ***vs.*** immobile), emphasizing the need to consider ripples other than the dominant i-nonθ ripples. Finally, we found that ***θ ripple***s expressed a strong phase preference (range [π/2,π]) with respect to the θ oscillation. Together, our analyses provide direct quantitative evidence urging the need to revisit the dichotomy between the two rhythms, by demonstrating their co-occurrence during different behavioral states.